Practical Media Using Real Products in Bandung State Polytechnic for Manufacturing

Gamawan Ananto
Bandung State Polytechnic for Manufacturing
Jl. Kanayakan 21, Bandung 40135, INDONESIA
E-mail: gamawan@polman-bandung.ac.id

ABSTRACT

In Bandung State Polytechnic for Manufacturing (Polman), like other vocational education institution, practical program in its workshop had the aim to build students skill competencies. For those, number of items in a structured exercise is created, combined with the real products from industrial collaboration that gave the benefits for both parties, such as fund generating for operation costs. Jobshop is the interesting type of products for the students due to its variety challenges, used the 'process group' layout that had advantages for variety requirements, and its appropriateness with practical media work. Jobshop items are normally initiated by inquiry or demand. Many projects may confirmed in the short term of time, or could be only few demands on the other period. Therefore this jobshop had the machine load fluctuation consequence regarding variety process needed and inquiries dependence. Minimizing such fluctuation, Batch Product could be combined for buffering media work and keep the education program machining operation is running due to Batch certain demand and time. Regarding the characteristic differences between jobshop and batch --that used 'product group' layout-- related with competency that the students should get, creating batch area separately caused better time schedule and order handling properness. It also encourages the student practical product spectrum wider since its comprehensive activities in each area and more focus execution of all involved parties to each kind of jobs. The other important thing is that order handling arrangement should be well planned and prepared. Any inquiries must be handled with good coordination in the organization professionally regarding the QCD necessity in the real production activity.

Keywords: *real products, machine layout*

INTRODUCTION

In the vocational education institution like Bandung State Polytechnic for Manufacturing (Polman), practical program in its workshop had the aim to build students skill competencies. For those, number of items in a structured exercise is created, combined with the real products from industrial collaboration.

In a structured exercise, products that used for media work referred to each type of machine on the initial weeks or months of education period, and rising up with more complicated part or sub assy work on the next level. Most of such product results became 'material waste' as those are made for machine competency based, instead of real demand.

In fact, those exercise works are combined with the real products from industrial collaboration that gave the benefits for both parties. Through this concept, students could follow the recent technological needs of industries, as well as it contributed self funding operation costs for organization, either for material and process. The students are also doing practical jobs inquired by real customer with the QCD (quality-cost-delivery) necessity, that give atmosphere like in the real situation that they will get in the future. From other side, customers could utilize the educational institution capacity and capability as one of their vendor to produce or develop products for supporting their needs.

JOBSHOP AND BATCH PRODUCT

In the manufacturing field, Jobshop is the interesting type of products for students practical media due to its variety challenges that not caused boredom. This kind of job is suitable to laboratory "process group"

machine layout that had advantages like flexibility for variety requirements with its jumbled flows and using general purpose machines, instead of specialized equipments[3]. The most of vocational education institutions in manufacturing preferred and implemented this kind of layout, due to practical media work appropriateness. Jobshop products are only very limited quantity made. They are single components, mass production tools --such as injection mold, stamping dies, fixture-- or special purpose machine, which have variety process planning and flow through machines in the area.

Jobshop has the items that are always different from time to time, thus their challenges are exciting for the students. Once an injection Mold like shown in 'figure 01' -as an example- has to be pro-duced, many components of such mold will be processed in irregular and unique flow and operation through the variety of machines.

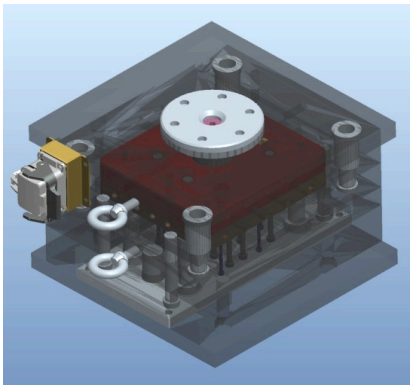

Figure 1. Plastic Injection Mold

After finished with a mold for product 'A' for instance, next project will be mold for 'B', 'C' etc. As 'market driver', these items are normally initiated by inquiry or external customer demand. Many projects may confirmed in the relatively short term of time, but in the next period could be only few demands asked; therefore jobshop had the consequence in machines load fluctuation due to variety process it needed and inquiries dependence.

Minimizing machines load fluctuation, Batch Product could be combined for buffering practical media work and keep the education program machining operation is running since it has certain demand in certain time annually, through a feasibility analysis[1]. Like the usual 'market driven', batch product has to be started with market and technical assessment, and penetrated to the market after the goods are finished, instead of answer the market demand by confirmation before processing the goods.

For such batch type, Bench Vice is chosen to be produced. As known, this Bench Vice is an equipment for work piece clamping in workbench, made of iron-casting for main parts and common steels for other components, as shown in 'figure 02'. There are also various processes needed for its components such as milling, drilling, dovetail milling for its main parts, turning or lathe, turning with ball attachement and assembly; in certain quantity[2].

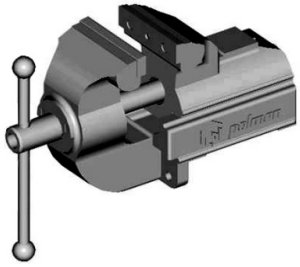

Figure 2. Bench Vice[2].

Since there are fluctuative number of demand as a captive market, these Bench Vice are treated as jobshop too. Sometimes obstacles are faced for producing such Bench Vices efficiently due to Polman machine layout that refers to "process group". Therefore difficulties to reach effective or ideal arrangement are occurred. There are long transport lines for Bench Vice components to be processed from one kind of machine to others.

Such layout seems not recommended for Bench Vice cases due to unmatched condition with advantages it has, Bench Vice production program is not variety product nor process and specialized machines or equipments may be used. Nevertheless, the students won't be bored in batch program as well as in jobshop, since they have various kind of jobs that referred to their practice schedule program by rotation, either kind of activity (managing, machining) or type of machine process (milling, turning, etc)[2].

METHODOLOGY

For example case, these kind of products will be simulated for a schedule planning in a jobshop area laboratory. There are a Mold as a jobshop product and 10 bench vise units from batch product.

Table 1. Part list and its operation plan

product	code nbr	part descrp	process1		process2		process3		process4	
			m/c	t (hour)	m/c	t (hour)	m/c	t (hour)	m/c	t (hour)
mold	1	upper base	M	5	G	2	D	4	ASSY	10
	2	lwr base	M	5	G	2	D	6		
	3	spacer	M	3	G	1	D	2		
	4	guide bush	L	4						
	5	guide column	L	2						
	6	cav insert	M	4	CNC	15	EDM	5		
	7	core insert	M	3	CNC	9				
bench vice	8	moving jaw	S	10	M	5	ASSY	10		
	9	fix jaw	S	15	M	10				
	10	lever	L	5						
	11	threaded bush	L	20						
	12	threaded shaft	L	15						
	13	insert jaw	M	8	D	5				

Table 1 shows the component list of these products with their simplified processing stage plan and estimated time. Sequentially, code numbers are given as well for each parts in order to identify easier on schedule chart. As mentioned, the quantity of Bench Vice is 10 units, thus the written duration time means the total time needed. For example 'assy = 10 hours' obtained from 1 hour per unit, milling = 5 hours (part nbr 8, process 2) is calculated from 0.5 hour per unit, etc.

These products are scheduled and to be processed simultaneously in Jobshop Area that shown in 'figure-03'. In many cases, due to strict finish date and delivery schedule necessity of jobshop, in this case is the Mold, there are constraints in prioritizing decision, especially in bottle neck situation for certain process.

Although various scheduling methods are implemented, the batch product tend to be pushed to unpriority in completion. As simulated in Figure 3, after 6 Bench Vices finished in assy process on day-4 hour-3, it is punctuated by Mold assy till day-5 for next 4 Bench Vices.

Since jobshop machine layout refers to process group, it is recommended for batch product to be set in special line or corner. Several type of machines that will be used for its components could be put in one area/ corner, where all related activities will be centralized. Machines and equipments for batch products will be located referred to each component flow and operation sequence, similar with a line flows with Group Technology cells [3] or 'product group' machine layout.

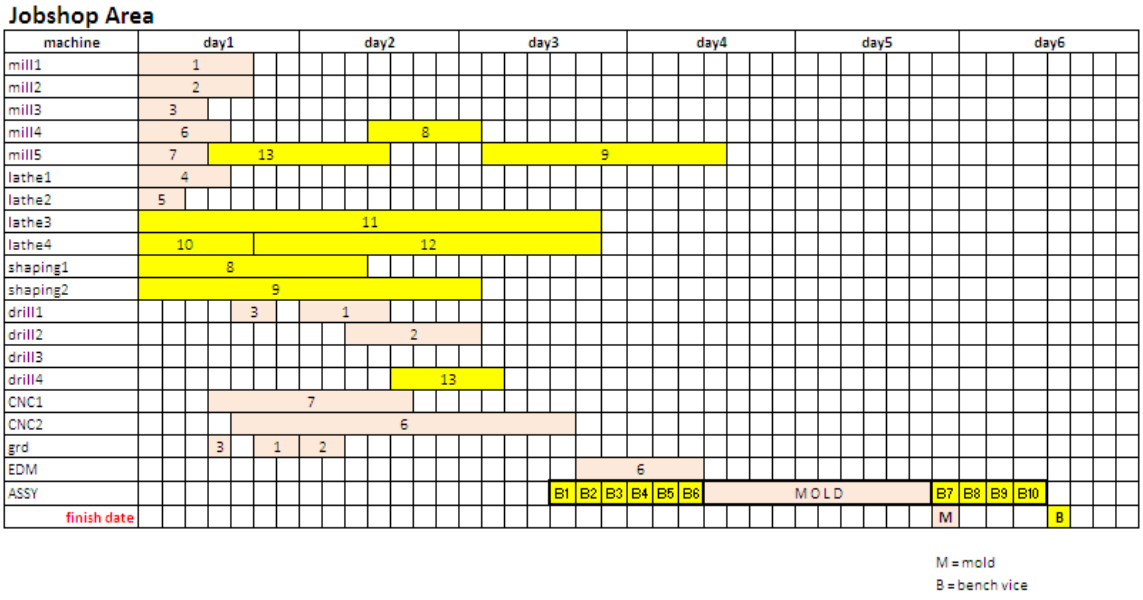

Figure 3. Mold and bench vice schedule in jobshop area

Figure 4 gives an idea of such layout. This area development caused the practical sub-program for the students will be enriched with new assy section in this Batch Area, completing the jobshop machining practical program for the students, and as well as that the assembly executors could more concentrate their job, either in Jobshop or Batch Area.

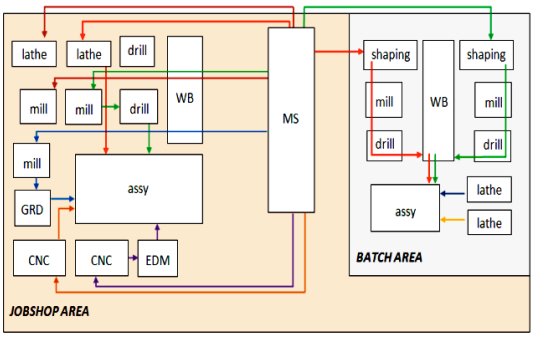

Figure 4. Separated Jobshop and Batch Area layout [2]

With such layout, schedule plan for mentioned products is simulated in 'figure-05'. It is shown that Bench Vice had improved its finish date comparing with previous condition in Jobshop Area, from day-6 hour-4 became day-4 hour-6, meant that this separated area caused better efficiency in bench vice components machining due to unnecessary activities decreasing.

RESULT AND DISCUSSION

As this model is treated like comprehensive 'small company', the students will be involved with planned schedule into all related activities in the product flow, these are all material and process planning (routing & dispatching), input receiving from warehouse/ logistic, execute the machining process included incoming check & outgoing check, assembly and finished product handling.

In addition, using real products from real customers for students practical media is such comprehensive exercise in manufac-turing. From the real enterprise point of view, there are 3 ingredient functions that will be bonded each other as a frame: Marketing, Finance and Operation. In this production program the students then will be pushed to take care of providing market demand properly, involved intensively in operation and take care of any actions that influencing cost or finance consequence. In brief words they really be faced to essential production issues, either Quality, Cost or Delivery (QCD).

Jobshop Area

machine	day1	day2	day3	day4	day5
mill1	1				
mill2	2	7	3		
mill3	6				
lathe1	4				
lathe2	5				
drill1		1	3		
drill2		2			
CNC1		7			
CNC2		6			
grd	1	2	3		
EDM				6	
ASSY					
finish date					M

Batch Area, for Bench Vice product

machine	day1	day2	day3	day4	day5
lathe3	11				
lathe4	10	12			
shaping1	8	9			
shaping2	9				
mill4		8	9		
mill5	13	8	9		
drill3		13			
drill4		13			
ASSY					
finish date				B	

Figure 5. Simulated schedule of mold and bench

As an industrial model, it would enhance the perspective of students that become professionals in the future. They will be accustomed to work properly in order not to 'stop' the continuous production line, think wider to treat next process as a customer, be a more professional and responsible workforce.

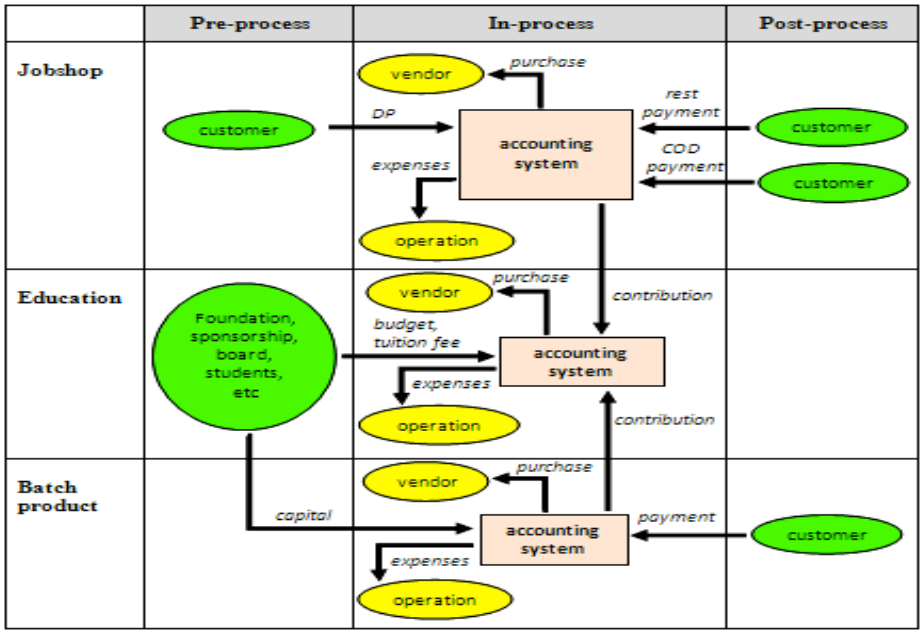

Figure 6. Jobshop and batch product contribution to education financing [2]

Regarding education financing, the cost needed for vocational education generally got from the foundation, sponsorship, board budgeting, students tuition fee, for operational expenses of electricity, machine power, raw material/ standard components purchasing etc. Referred to basic and general concept of industrial service activity program for the students, this also one of fund generating alternative in cost contribution for organization.

Figure-06 simulates how jobshop activity contributes education funding from its accounting system. Batch Product do the same achievement but from different way in the matter of term of time, in post-process only when the goods are sold.

Last but not least, the order handling arrangement should be well prepared from the beginning, by the board, management on the strategic level. Any inquiries, especially from external customer form industries must be handled with good coordination between all involved parties in the organization in professional way. Such agreed inquiries should be well planned in scheduling and well controlled in execution. The order flow handling process of these kind of jobs is shown in general by 'figure-07'

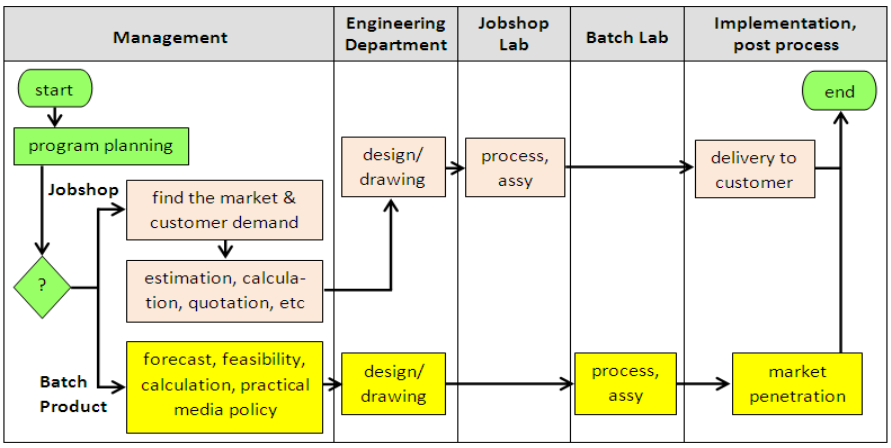

Figure 7. General order flow for jobshop, batch and research result project

Using real products from real custo-mers for practical media is implemented in Bandung State Polytechnic for Manufac-turing (Polman) for introducing real industrial atmosphere to the students in such vocational education. Since the type of jobshop product had the appropriateness with practical media work, jobshop with its 'process group' layout is chosen in Polman laboratory or workshop area. Through the staged development, batch area is created separately in order to reach better efficiency in batch process. This used 'product group' machine layout with specific assy section that caused practical sub-program for the students is enriched, and gave comprehensive activities.

With a professional and proper order handling, referred to basic and general concept of industrial service activity program for the students, this also a fund generating alternative in cost contribution that supported either for material and process expenses. For those, Jobshop and Batch Product had the same achievement but from different way in the term of time matter.

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